4-1. Low Impact Development (LID) "Interception Practices"

Low Impact Development (LID) involves a design approach that begins early in the site design process, well before the designer makes decisions about density, placement of buildings, configuration of roadways and other infrastructure, and the design of structural stormwater best management practices (BMPs). The strategy consists of a design approach that discerns how water moves through the landscape under existing conditions, and then works with those site characteristics and drainage patterns to integrate the development design with natural drainage features and functions. There are essentially three major components to LID design:

1. *Site Planning:* Overall site planning to preserve natural vegetation, minimize the creation of impervious surfaces, and maximize the use of existing drainage patterns and drainage features. This type of planning requires an analysis of the site and its local setting, to develop an understanding of natural features, existing drainage patterns, and the water courses that will receive drainage from the project. The preservation of Undisturbed Cover (UDC) is one component of this step in the LID design process, and is described in Volume 1 of the NH Stormwater Manual.

2. *Hydrologic Management:* Development design that provides for the "disconnection" of impervious surfaces from the site drainage collection system. This involves such measures as directing roof runoff and runoff from pavements to overland flow, to encourage surface infiltration and water quality treatment, to help reduce the increase of runoff that results from these paved surfaces. Disconnection practices help minimize Effective Impervious Cover (EIC), as described in Volume 1 of this manual.

3. *LID Structural Practices:* Application of structural Low Impact Development Best Management Practices (BMPs), to collect the remaining runoff generated by the development and manage it in facilities designed to promote infiltration and water quality treatment through natural processes (such as adsorption of contaminants within soil materials and uptake of nutrients by vegetation).

The following further outlines the LID design approach:

1. Site Planning:
    a. Use site hydrology as the integrating framework;
    b. Control stormwater at the source;
    c. Preserve natural drainage paths and features (not just the regulated resource areas);
    d. Consider ridges for development and valleys for stormwater management;
    e. Identify areas with soils most conducive to infiltration, and use them for that purpose;

f. Strategically place impervious areas where soils are less conducive to infiltration, to minimize the loss of natural recharge;
g. Minimize impervious surfaces – build “up” rather than “out;”
h. Minimize impervious surfaces – carefully consider road lengths and widths, parking requirements, pedestrian access;
i. Minimize directly connected impervious surfaces.

2. Hydrologic management techniques:
    a. Design to maximize roof disconnection;
    b. Provide for collection of roof runoff for irrigation purposes (rain barrels and cisterns);
    c. Maximize disconnection of impervious surfaces;
    d. Maximize drainage flow paths over pervious areas;
    e. Consider “country” drainage versus piped systems.

3. LID management practices:
    a. Minimize runoff from roofs (e.g., green roofs);
    b. Minimize runoff from pavements (e.g., permeable pavement systems);
    c. Convert concentrated flow to sheet flow (e.g., level spreaders);
    d. Manage sheet flow (e.g., vegetated buffers);
    e. Manage concentrated flow (e.g., vegetated channel BMPs)
    f. “Micromanage” discharges (e.g., dry wells, bioretention areas/rain gardens).

The following LID “Interception” practices are discussed in this Section:

1. Green Roof

2. Rain Barrel/Cistern

Other LID structural practices are discussed under “Treatment Practices,” including:

- Bioretention Systems, including Rain Gardens (see Filtering Practices)

- Permeable (Pervious) Pavement: see Filtering Practices – Permeable Pavement

GREEN ROOFS

General Description

A green roof is a building roof that is partially or completely covered with vegetation and soil, or other type of growing medium. It can be applied to new construction or retrofitted to existing construction. A typical green roof includes vegetation planted in a substrate over a drainage layer and a root barrier membrane. Some green roofs are equipped with stormwater detention tanks with a recirculating system that allows for watering of the media during dry periods. There are generally two classes of greenroofs: 1) extensive; and 2) intensive.

Extensive green roofs generally have only a few inches of growth media and are relatively lighweight in structure. They are designed to be low-maintenance and are not designed for public access. Vegetation is typically limited to various species of sedums or other similar arid plants.

Intensive green roofs are designed to be used by the public or building inhabitants as a park or relaxation area. Intensive green roofs typically require more growth media, greater than six inches in depth, adding a significant additional weight loading to the building. This requires greater capital and maintenance investments than extensive green roofs.

Green roofs can be constructed layer by layer, or can be purchased as a system. Several vendors offer modular trays containing the green roof components.

Green roofs provide several benefits over conventional roofing, including:

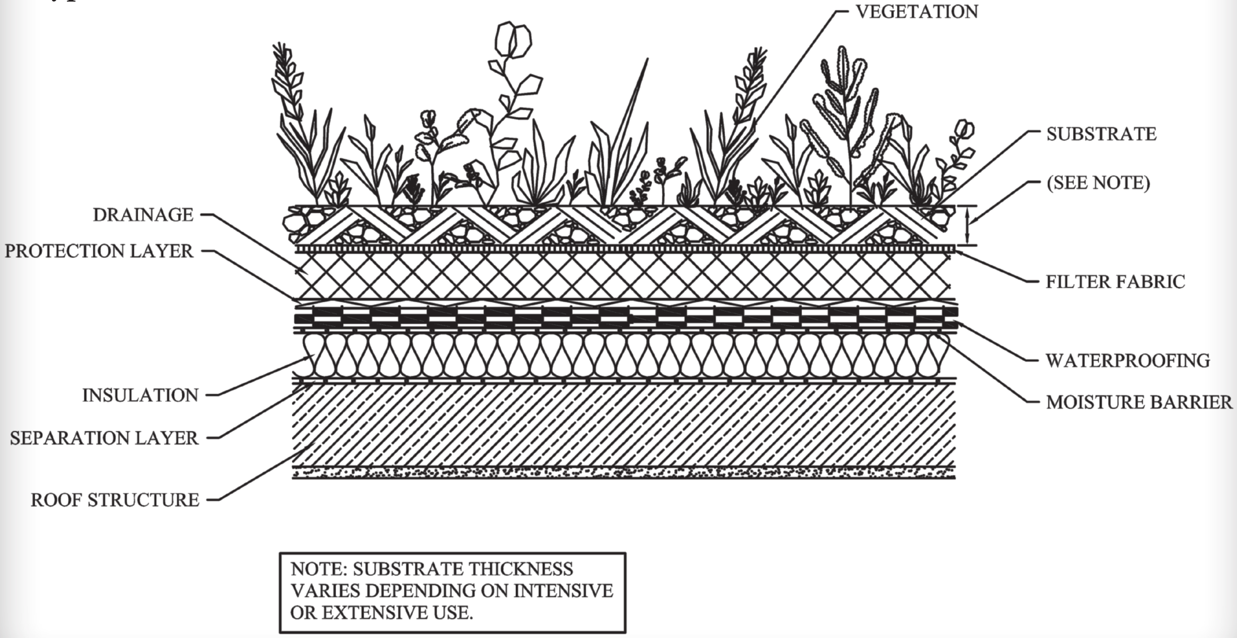
- Reduction of stormwater runoff from buildings through absorption, storage and evapotranspiration. This reduces overall peak flow discharge to a storm sewer system and can result in less in-stream scouring, lower water temperatures and better water quality;
- Reduction of urban heat island effects with increased building thermal insulation and energy efficiency;
- Increased roof durability and lifespan.

Design Considerations

- Green roofs can add significant weight load to a building. A structural engineer should be consulted to ensure the building can support the added weight at maximum water capacity or fully saturated conditions.
- On high pitched roofs, incorporate special design features, such as structural anti-shear protection, to prevent slumping and ensure plant survival.

Example Design

Typical Green Roof Profile



Maintenance Requirements

- Immediately after construction, inspect green roofs regularly until the vegetation has established. Water as needed to establish vegetation.
- After vegetation has established, inspect and fertilize extensive green roofs at least annually. Replace dead vegetation as needed.
- Weed green roofs as needed.
- Water extensive green roofs as needed during exceptionally dry periods.
- Maintain intensive green roofs as any other landscaped area. This will involve mulching, weeding, irrigation and the replacement of dead vegetation.

Design References

- Maine DEP (2006)
- EPA (2006a)

Design Criteria

Designers will need to work closely with building design professionals to identify applicable criteria, codes, and accepted standards of practice for the design of green roofs.

RAIN BARRELS / CISTERNS

Rain barrels and cisterns are storage devices used to collect rainwater from roof downspouts for later reuse. They provide the benefit of reduced stormwater runoff and conservation of water supplies when the water is reused. Stormwater collected in rain barrels and cisterns can typically be reused for such purposes as irrigation of lawns and gardens, wash water and other non-potable uses.

Rain barrels are most commonly used in residential applications to collect roof runoff for later watering of lawns and gardens. Rain barrels come in all shapes and sizes and can be purchased or made at home from existing materials. The low cost and maintenance associated with rain barrels makes them an attractive option for homeowners to manage rooftop runoff.

Cisterns are above or underground storage tanks used to collect roof runoff. While providing the same function as rain barrels, cisterns are generally larger and may include pumps and filtration devices to reuse the water. The larger storage capacity allows for greater reuse opportunities.

Design Considerations

- Rain barrels should hold a minimum of 55 gallons
- Rain barrels can be connected in series to provide larger storage volumes
- Size cisterns for the volume needed for the intended reuse of water
- Equip rain barrels with a drain spigot near the bottom of the barrel with garden hose threading to allow easy hook up and use for watering
- Incorporate the use of water pumps and filters into cisterns as needed for the intended reuse of the water
- Provide an overflow pipe
- Provide removable, child-resistant covers
- Provide mosquito screening on water entry holes to prevent mosquito breeding in standing water

Design References

- Maine DEP (2006)
- Low Impact Development Center (2007)

Example Design

Typical Rain Barrel

Maintenance Requirements

- Inspect rain barrel for potential leaks
- Inspect overflow pipe and overflow area to ensure that overflow is draining in non-erosive manner
- Inspect spigot to ensure it is functioning correctly
- Inspect screen and cover to ensure they still function as anticipated and replace if needed
- To prevent damage by freezing water, drain rain barrel and disconnect it from roof leader prior to winter; reconnect in spring.
- Inspect larger cisterns at least annually for accumulation of sediment and debris, and clean cistern as warranted by inspection. Cisterns may require servicing under the supervision of a qualified professional, including periodic disinfection to control bacteria growth, or application of larvicide to control mosquitoes